

# Knowledge, Attitudes, and Practices Regarding Epidemiology and Management of Travelers' Diarrhea: A Survey of Front-Line Providers in Iraq and Afghanistan

**Guarantor:** CDR John W. Sanders, MC USN

**Contributors:** LCDR Mark S. Riddle, MC USNR\*; David R. Tribble, MD DrPH†; LCDR Nishith K. Jobanputra, MC USNR‡; CPT James J. Jones, APA-C MPAS USA§; LCDR Shannon D. Putnam, MSC USN¶; CAPT Robert W. Frenck, MC USN; CDR John W. Sanders, MC USNR\*

To evaluate the relationship between medical knowledge and clinical practice, a survey on travelers' diarrhea was administered to military health care providers attending a professional development and trauma management conference. The survey was administered at the beginning of the conference and 58 of the 76 attendees participated by completing a questionnaire. Respondents were aware of the standard definition of travelers' diarrhea; however, their knowledge about the epidemiology and management of travelers' diarrhea was low. Less than one-third correctly answered questions on etiology and more than two-thirds made incorrect management choices in treatment of mild to moderate watery diarrhea and dysentery. Important knowledge gaps about gastroenteritis were identified and should serve as a basis to develop military-specific clinical guidelines and training programs.

## Introduction

Research efforts by the Department of Defense have significantly increased our knowledge about the epidemiology and management of travelers' diarrhea.<sup>1-4</sup> However, little has been done to study whether this knowledge has been effectively disseminated to operational health care providers. Although there are several published reports on provider's knowledge, attitudes, and practices in military settings, none have focused on infectious diseases.<sup>5-10</sup> As part of a mid-deployment training conference in Doha, Qatar, we conducted a knowledge, attitudes, and practice assessment of current operational health care providers (primarily physician assistants) deployed in support of Operation Iraqi Freedom (Iraq) and Operation Enduring Freedom (Afghanistan) with regard to travelers' diarrhea epidemiology and management. In addition, we asked health care providers about their impression of the burden and impact and the adequacy of education and prevention with respect to travelers' diarrhea. The primary objective of the survey instrument was for educational purposes in a conference setting and secondarily to determine consistencies and gaps in each of these knowledge, attitude, and practice areas.

\*Naval Medical Research Unit No. 3, Cairo, Egypt.

†Enteric Disease Department, Naval Medical Research Center, Silver Spring, MD 20910.

‡Navy Environmental Preventive Medicine Unit No. 7, Sigonella, Italy.

§Army Central Command-Troop Medical Clinic, Doha, Qatar.

¶Naval Medical Research Unit No. 2, Jakarta, Indonesia.

This manuscript was received for review in February 2005 and accepted for publication in March 2005.

## Methods

Seventy-six physicians, physician assistants, and medics attended a professional development and trauma management conference in Doha, Qatar, in December 2003. All attendees were health care providers assigned to forward-deployed combat units within Iraq and Afghanistan. A multiple-choice survey was developed by clinical researchers with expertise in travelers' diarrhea (TD). The survey assessed knowledge, attitudes, and practices related to diarrhea epidemiology and management. In addition, participants were asked to rank their impressions about the clinical frequency and operational impact of TD in their current practice, relative to other diseases and nonbattle injury (DNBI). The survey also assessed the health care provider's attitudes regarding adequacy of training and field preventive measures to manage and prevent TD. The survey included a number of question formats including ranking, multiple choice, and Likert-type scale. Multiple-choice questions on diagnosis and management were scenario based.

The survey was administered before conference participants receiving updates on the epidemiology and management of infectious diarrhea. The survey, which was primarily designed as a teaching tool for introducing the topic of travelers' diarrhea, was performed without collection of personal identifiers other than the medical level of the provider (i.e., physician, physician assistant, or medical technician).

Analysis of the survey was primarily descriptive. Composite rank scores of morbidity and operational impact were computed by summation of individual rank scores for each DNBI and battle injury categories. Multiple-choice questions were scored for correct/noncorrect and collapsed into composite scores for areas of epidemiology and management. Correct answers were developed by consensus among three clinicians with more than 30 years combined experience in research and clinical management of TD and were based on published treatment guidelines.<sup>11,12</sup> The case presentation/management scenarios were designed to have a step-wise increase in complexity and/or severity. The choices of treatment and management, ranging from simple rehydration and follow-up, to management with antibiotics and antimotility agents, were identical for each of the clinical scenarios.

Analysis was conducted to determine whether there was a trend of increasing level of care associated with increasing severity of illness. For this analysis, the data set was expanded to include an individual observation for each of five (nondysentery and nonpersistent) diarrhea clinical scenarios of increasing severity and complexity. Each scenario question was assigned an

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE <b>JUN 2005</b>		2. REPORT TYPE <b>N/A</b>		3. DATES COVERED <b>-</b>	
4. TITLE AND SUBTITLE <b>Knowledge, Attitudes, and Practices Regarding Epidemiology and Management of travelers' Diarrhea: A Survey of Front-Line Providers in Iraq and Afghanistan</b>				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>Naval Medical Research Unit No. 3 Cairo, Egypt</b>				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) <b>Naval Medical Research Center 503 Robert Grant Avenue Silver Spring, MD 20910-7500</b>				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release, distribution unlimited</b>					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT <b>SAR</b>	18. NUMBER OF PAGES <b>4</b>	19a. NAME OF RESPONSIBLE PERSON
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>			

ordinal ranking from 1 to 5 (from "mild" to "most severe"). Similarly, an ordinal ranking of four levels of care (from "minimal" to "more involved") was assigned for each choice in management. To evaluate whether there was an association between increasing severity of illness and increasing level of care, an ordinal logistic regression model was fit with level of care and severity of illness as the outcome and predictor variables, respectively. Because transformation of the data set generated multiple individual observations for each question, a cluster option was specified for each attendee to control for observations being independent across individual attendees (clusters) but not necessarily within individual attendees (e.g., control for repeated measures).<sup>13</sup>

Statistical significance for all associations was set at the  $p \leq 0.05$  level. All analyses were performed using Stata version 8.0 (College Park, Texas). This study was performed as part of an educational format and thus was exempt from the requirement for Institutional Review Board approval.

## Results

Fifty-eight (76%) providers completed and returned the knowledge assessment survey. Information from providers not completing the survey was not obtained. Of those completing the survey, 46 (81%) of the respondents identified themselves as physician assistants and 6 (11%) as physicians. Participants reported gastrointestinal disease as the number one cause of clinic visits and the illness with the largest overall impact on the success of the mission (Table I). Other health conditions resulting in frequent clinic visits included respiratory illness and nonbattle injury. Both combat and nonbattle injuries were reported to affect the overall mission.

Eighty-one percent of attendees were able to correctly identify the standard definition of TD; however, only 14% correctly identified bacterial etiology as the most common cause of TD (Table II). Similarly, less than one-third correctly identified the most common cause of watery diarrhea and persistent diarrhea (defined as diarrhea lasting >14 days) and less than one-half correctly identified the most common cause of dysentery and vomiting-predominant illness.

Incorrect responses to the clinical scenarios presented in the questionnaire were common, with only 30% of respondents identifying the appropriate evaluation and treatment of mild to moderate diarrhea. Knowledge about empiric treatment for severe watery diarrhea, dysentery, or persistent diarrhea was also

TABLE II  
PROVIDER CORRECT RESPONSES TO MULTIPLE CHOICE  
QUESTIONS REGARDING DIARRHEA DEFINITION, EPIDEMIOLOGY,  
ETIOLOGY, AND DIAGNOSIS/MANAGEMENT (N = 58)

Knowledge Area, n (%)	Correct Answer	n (%)
Definition		48 (81)
Epidemiology		
Most common cause	Bacteria	8 (14)
Watery	Enterotoxigenic <i>E. coli</i>	13 (22)
Dysentery	<i>Shigella</i>	22 (38)
Persistent	<i>Giardia</i>	19 (33)
Vomiting predominant	Norwalk virus	24 (41)
Management		
Mild watery		6 (10)
Mild to moderate watery		12 (21)
Moderate watery		14 (24)
Severe watery		25 (43)
Severe inflammatory		23 (40)
Dysentery		17 (29)
Mild persistent		4 (7)
Moderate persistent		24 (41)

poor, with only 40% of the participants answering correctly. However, health care providers did appropriately vary the care provided the patient by the severity of illness presented in the case scenario ( $\beta_{\text{coeff}} = 0.6$ ,  $p < 0.0001$ ; Table III).

Additional patient management questions revealed that 80% of providers reported using antibiotics for treatment of TD less than 35% of the time. If antimicrobials were prescribed, the most common choice was a 3-day course of ciprofloxacin, although 30% of the providers prescribed antimicrobials for 5 or 7 days. Furthermore, nearly two-thirds (63%) of the providers reported using the antimotility agent loperamide less than 50% of the time in the management of TD.

Among survey items addressing subjective attitudes, nearly 95% agreed or strongly agreed that diarrhea was an important health concern among our deployed troops and 80% thought that diarrhea had a major impact on mission objectives (Table IV). Additionally, more than 40% thought that troops did not receive adequate preventive medicine briefings before deploying and more than 60% thought preventive medicine measures in the field were inadequate.

## Discussion

### Burden/impact

The health care provider's reported rank of clinical frequency and operational mission impact of TD relative to other health concerns are consistent with what is currently known among operational clinicians. Presently, TD is one of the most common medical problems for deployed military personnel, with an average cumulative attack rate of 36% per deployment and exceeding 70% during deployments in high-risk areas such as Southeast Asia.<sup>3</sup> Furthermore, the burden of enteric infectious disease (including TD and acute gastroenteritis) relative to other DNBI in U.S. deployed military forces has been described in a number of published reports<sup>3,14-19</sup> with enteric infectious disease often ranking in the top three among reasons for clinic visits.

TABLE I

PROVIDER RANKINGS OF HEALTH CONDITIONS MOST COMMON  
AND HAVING GREATEST IMPACT

Health Condition	Most Common Causes for Clinic Visits	Greatest Impact on Overall Military Mission
Gastrointestinal	1	1
Nonbattle injury	2	2
Respiratory	3	4
Dermatological	4	7
Battle injury	5	3
Urology/gynecologic	6	6
Psychiatric	7	5

TABLE III  
PROVIDER RESPONSES TO MANAGEMENT AND EMPIRICAL TREATMENT OF CLINICAL CASE SCENARIOS (N = 58)

Scenario	Provider Responses, n (%) <sup>a</sup>					
	Rehydration only	Rehydration + BS	Rehydration + Loper	Rehydration + CIP	Rehydration + CIP + Loper	Rehydration + MTZ + Loper
Mild watery	30 (52)	8 (14)	14 (24)	0	6 (10)	0
Mild to moderate watery	19 (33)	5 (9)	20 (34)	2 (3)	12 (21)	0
Moderate watery	15 (27)	10 (18)	10 (18)	6 (11)	14 (25)	1 (2)
Severe watery	8 (14)	3 (5)	9 (16)	10 (18)	25 (45)	1 (2)
Severe inflammatory	4 (7)	1 (2)	2 (3)	23 (40)	25 (43)	3 (5)
Dysentery	4 (7)	0	4 (7)	17 (30)	16 (29)	15 (27)
Mild persistent	4 (7)	3 (5)	13 (24)	12 (22)	12 (22)	11 (20)
Moderate persistent	1 (2)	2 (4)	4 (7)	9 (17)	14 (26)	24 (44)

<sup>a</sup> All responses included appropriate follow-up. BS, bismuth subsalicylate (Pepto-Bismol, Proctor & Gamble, Cincinnati, Ohio); Loper, loperamide (Imodium, McNeil Consumer and Specialty Pharmaceuticals, Fort Washington, Pennsylvania); CIP, ciprofloxacin; MTZ, metronidazole (Flagyl, Aventis Pharmaceuticals, Bridgewater, New Jersey).

TABLE IV  
PROVIDER ATTITUDES TOWARD THE IMPORTANCE, IMPACT, AND PREPAREDNESS IN MANAGING DIARRHEA AMONG TROOPS (N = 58)

Attitude	Provider Responses (%)				
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Diarrhea is an important health concern among our deployed troops.	63	32	4	2	0
Diarrhea has a major impact on mission objectives.	40	40	12	7	0
Diarrhea treatment (regimens or treatment algorithms) are straightforward and easily understood.	9	43	27	20	2
Troops receive adequate preventive medicine briefings prior to deploying.	9	34	16	29	13
Preventive medicine measures are adequate in the field.	0	21	16	44	19
I feel I have received adequate preventive medicine training.	12	46	16	21	5

### Epidemiology/Etiology

Although the majority of respondents knew the standard definition of diarrhea, they were not aware of the most common causes of TD, nor the predominant etiologies associated with the common clinical TD syndromes. In fact, 47% and 14% of the providers considered norovirus and *Vibrio cholerae*, respectively, as the primary cause of watery diarrhea and 29% considered enterotoxigenic *Escherichia coli* as the primary cause of dysentery. (data not shown) Numerous studies on TD have demonstrated bacteria to be the cause of over 80% of diarrhea among deployed troops, followed by viruses (<10%) and protozoa (<5%).<sup>20</sup> Enterotoxigenic *E. coli*, *Campylobacter*, and *Shigella* together account for approximately 60% of the cases of TD with cholera almost never being the agent responsible for the illness.

### Disease Management

Confusion about appropriate empiric treatment for TD was also common among respondents. Less than one-third of the providers reported management of mild to moderate watery diarrhea in travelers that was consistent with current guidelines.<sup>11,12</sup> This finding is consistent with a previously published study where more than one-third of the doctors, nurses, and pharmacists surveyed stated they would "take no action" in treatment of travel-related diarrhea and less than 5% would

recommend an antibiotic.<sup>21</sup> Additionally, in the current survey, more than a third recommended use of an antimotility agent in dysentery cases, which is contrary to recommended practices.<sup>12</sup>

Although not routinely accepted, many experts in the field of travel medicine recommend use of antimicrobial agents for the treatment of travelers' diarrhea.<sup>22-27</sup> Although many regimens exist, administration of a single dose of fluoroquinolone antibiotic with an antimotility agent (loperamide) has gained favor among experts.<sup>11,12</sup> Single-dose regimens, in addition to simplifying treatment and increasing compliance, should also provide cost savings. In the current survey, only 16% of the providers used a single-dose antimicrobial regimen with a 3-day course of antimicrobials being the most common (51%) regimen used and 30% of the respondents thought 5 to 7 days of antimicrobials were needed to treat travelers' diarrhea.

Additional information regarding management of TD that is important, but was not tested, is the current knowledge that azithromycin is the antibiotic of choice for empiric treatment of TD in Southeast Asia and other areas of the world where the prevalence of fluoroquinolone-resistant *Campylobacter* is quite high. Four percent of the respondents reported azithromycin as their first choice of antibiotics and 18% reported a single-dose regimen.

Survey respondents also reported significant inadequacies regarding field measures and preventive medicine training. This

finding demands further evaluation, because these measures are vitally important to minimize the burden of TD, in addition to timely and appropriate diagnosis and treatment.

A small sample size was a primary limitation of this study. A larger sample with a diverse group of providers (e.g., medics, nurses, physician assistants, physicians) would have not only provided more power, but also would have allowed us to evaluate any associations with level of training. Other limitations are largely based on the fact that the survey questionnaire was designed primarily as a teaching tool and not as a research instrument. The validity of the instrument to measure knowledge, attitudes, and practice behaviors was not formally assessed. Additionally, there was a probable lack of independence between answers of etiology and diagnosis/treatment among observations. Notwithstanding the discussed limitations, the general lack of knowledge about TD was notable. A final limitation was the lack of data on the number of years the providers were delivering health care to determine whether there was a relationship between clinical experience and the knowledge about TD.

Despite these limitations, the results of this survey identify important knowledge gaps and should emphasize the need for military-specific clinical guidelines and training programs. Clinical practice guidelines have been identified as an important means of integrating current best evidence into practice.<sup>28</sup> We recommend that the Department of Defense develop and disseminate evidence-based guidelines on the treatment and management of TD in deployed troops to effectively reduce the important burden of illness and to protect and preserve the warfighters' capabilities.<sup>3,29,30</sup>

### Acknowledgment

We thank Ms. Jaime Bland and CPT Kenneth Brooks from Army Central Command-Troop Medical Clinic for the assistance in collecting the survey data. We also thank Manal Mostafa and Amany Badawy for their work on data entry and analysis.

### References

1. Connor P, Farthing MJ: Travellers' diarrhoea: a military problem? *J R Army Med Corps* 1999; 145: 95-101.
2. Cook GC: Influence of diarrhoeal disease on military and naval campaigns. *J R Soc Med* 2001; 94: 95-7.
3. Sanchez JL, et al: Diarrheal disease incidence and morbidity among United States military personnel during short-term missions overseas. *Am J Trop Med Hyg* 1998; 58: 299-304.
4. Sanders JW, et al: An Observational Clinic-Based Study of Diarrheal Illness in Deployed U.S. Military Personnel in Thailand: Presentation and Outcome of *Campylobacter* Infection. In: 49th Annual Meeting of the American Society of Tropical Medicine and Hygiene, Washington, DC, 1999.
5. Antonacci MA, Eyck RT: Utilization and effectiveness of an emergency department initiated smoking cessation program. *Acad Emerg Med* 2000; 7: 1166.
6. Chisick MC, Richter P, Piotrowski MJ: Dental health promotion and preventive dentistry practices of U.S. Army dentists. *Milit Med* 2000; 165: 604-6.
7. Conway TL, Hurtado SL, Woodruff SI: Navy health care provider attitudes and practices concerning patient tobacco use. *Milit Med* 1996; 161: 510-20.
8. Grayson K, Bush AC, Ryan K: Assessing provider attitudes toward mandated prevention practices. *Milit Med*, 2000; 165: 916-20.
9. Hunter CL, Hunter CM, West ET, Kinder MH, Carroll DW: Recognition of depressive disorders by primary care providers in a military medical setting. *Milit Med* 2002; 167: 308-11.
10. Schwerin MJ, Sack DM: Shipboard women's health care: provider perceptions. *Milit Med* 1997; 162: 666-70.
11. DuPont HL: Treatment of travelers' diarrhea. *J Travel Med* 2001; 8(Suppl 2): S31-3.
12. Adachi JA, et al: Empirical antimicrobial therapy for traveler's diarrhea. *Clin Infect Dis* 2000; 31: 1079-83.
13. Froot KA: Consistent covariance matrix estimation with cross-sectional dependence and heteroskedasticity in financial data. *J Finan Quant Anal* 1989; 24: 333-55.
14. Wasserman GM, et al: A survey of outpatient visits in a United States Army forward unit during Operation Desert Shield. *Milit Med* 1997; 162: 374-9.
15. Buma AH, van Ameijden E, Huyboom M: Morbidity surveillance among Dutch troops during a peace support operation in Cambodia. *Milit Med* 1999; 164: 107-11.
16. Sanchez JL Jr., et al: Health assessment of U.S. military personnel deployed to Bosnia-Herzegovina for operation joint endeavor. *Milit Med* 2001; 166: 470-4.
17. Gambel JM, Drabick JJ, Martinez-Lopez L: Medical surveillance of multinational peacekeepers deployed in support of the United Nations Mission in Haiti, June-October 1995. *Int J Epidemiol* 1999; 28: 312-8.
18. McKee KT Jr., Kortepeter MG, Ljaamo SK: Disease and nonbattle injury among United States soldiers deployed in Bosnia-Herzegovina during 1997: summary primary care statistics for Operation Joint Guard. *Milit Med* 1998; 163: 733-42.
19. Taylor SF, Lutz RH, Millward JA: Disease and nonbattle injury related to peacekeeping operations in South America: summary patient care statistics for CABANAS 2000. *Milit Med* 2001; 166: 1059-61.
20. Castelli F, Carosi G: Epidemiology of traveler's diarrhea. *Chemotherapy* 1995; 41(Suppl 1): 20-32.
21. McIntosh IB, Swanson V, Howell K: Health professionals' attitudes toward acute diarrhea management. *J Travel Med* 2001; 8: 60-5.
22. Connor MP, Green AD: Travellers' diarrhoea and use of single-dose ciprofloxacin. *Lancet* 1995; 345: 381-2.
23. Kuschner RA, et al: Use of azithromycin for the treatment of *Campylobacter enteritis* in travelers to Thailand, an area where ciprofloxacin resistance is prevalent. *Clin Infect Dis* 1995; 21: 536-41.
24. Hipskind JE: A prophylactic program to prevent traveler's diarrhea in United States Naval personnel comparing doxycycline and trimethoprim-sulfamethoxazole. *Milit Med* 1993; 158: 141-4.
25. Thornton SA, et al: Norfloxacin compared to trimethoprim/sulfamethoxazole for the treatment of travelers' diarrhea among U.S. military personnel deployed to South America and West Africa. *Milit Med* 1992; 157: 55-8.
26. Petrucci BP, et al: Treatment of traveler's diarrhea with ciprofloxacin and loperamide. *J Infect Dis* 1992; 165: 557-60.
27. Taylor DN, et al: Treatment of travelers' diarrhea: ciprofloxacin plus loperamide compared with ciprofloxacin alone: a placebo-controlled, randomized trial. *Ann Intern Med* 1991; 114: 731-4.
28. Cretin S, Farley DO, Dolter KJ, Nicholas W: Evaluating an integrated approach to clinical quality improvement: clinical guidelines, quality measurement, and supportive system design. *Med Care* 2001; 39(Suppl 2): 1170-84.
29. Sanders JW, et al: The epidemiology of self-reported diarrhea in operations Iraqi freedom and enduring freedom. *Diagn Microbiol Infect Dis* 2004; 50: 89-93.
30. Hyams KC, et al: The impact of infectious diseases on the health of U.S. troops deployed to the Persian Gulf during operations Desert Shield and Desert Storm. *Clin Infect Dis* 1995; 20: 1497-1504.